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The new Eurovision Control Centre in Geneva

B.G. Flowers (EBU)

Most engineers and technicians working in operational areas spend a certain amount of their time inventing new, better and more cost-effective ways to do their work. Often, such reveries are little more than exercises in inventing a better mouse-trap and are destined to be forgotten if only because the opportunity never arises to put the ideas into practice.

Just now and again, however, there comes a chance to re-build an entire system. Here Brian Flowers, long-time Head of the Eurovision Control Centre in Brussels, gives an account of his work to design the new EVC in Geneva, for which he is Project Manager. If the old mouse-trap was PAL/SECAM/NTSC, the new one will be analogue/digital, composite/component and 4:3/16:9, with provision for future HDTV.

1. Background

At the beginning of 1988, the European Broadcasting Union decided to move its Technical Centre, including the Eurovision Control Centre (EVC), from Brussels to Geneva. Shortly thereafter I began to prepare the specification for the new Eurovision Control Centre in Geneva (EVC-G).

At this stage it was envisaged to install the EVC-G in the existing EBU Headquarters building in Geneva, adding another floor to provide additional office space. This solution was found to be unacceptable and it was subsequently decided to build a completely new building opposite the existing building. The EVC-G will be installed on the ground floor of this new building, with the layout shown in *Fig. 1*. Delays in the procurement of the ground and granting of building permission caused a two-year delay, so the target date for completion of the EVC-G slipped from mid-1991 to mid-1993.

At this point it is perhaps useful to define the basic responsibilities of the EVC as follows:

- To ensure that the required network is established on time for each transmission, by coordinating network switching with the national technical coordination centres (CNCTs).
- To monitor the quality of the network and take corrective action when necessary.
- To record the real-time circuit utilisation for cost-clearing.
- To pre-record intercontinental news items for subsequent distribution in the regular news exchanges.

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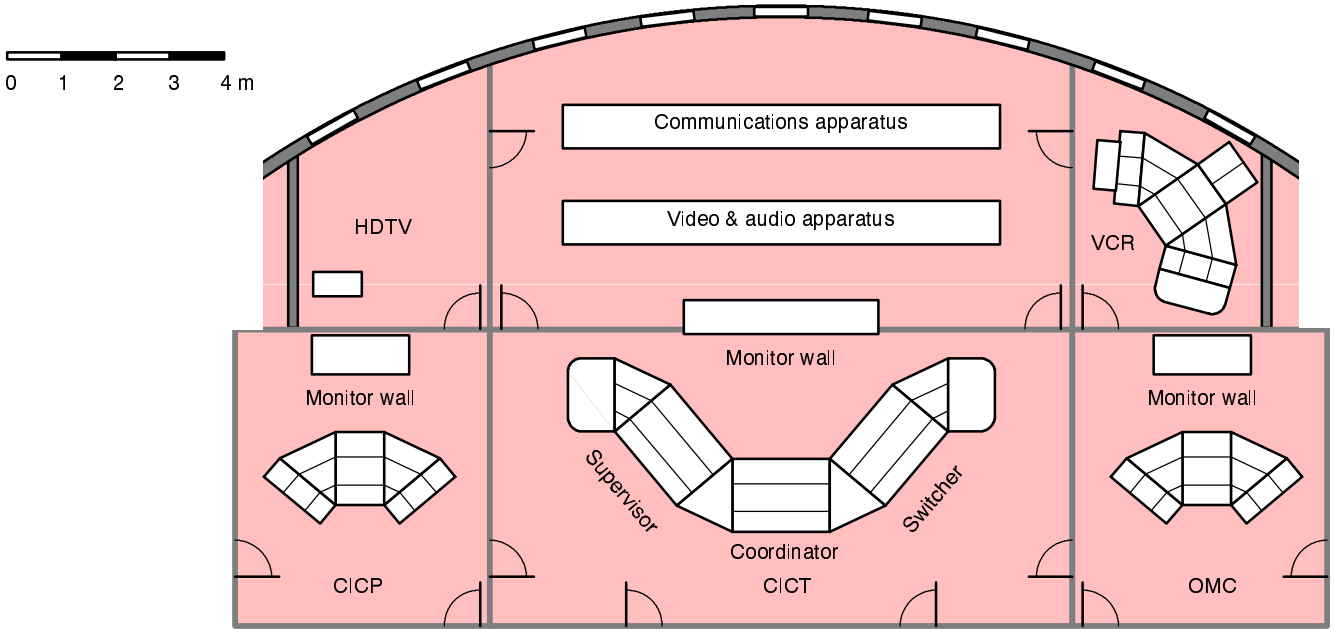


Figure 1
Arrangement of operational areas in the EVC-G

2. Choosing the right technology

In 1990, whilst design work on the new EVC has been proceeding on the basis of conventional transmission technologies, the EBU Technical Committee decided to adopt component-digital video transmission at 34 Mbit/s on the Eurovision network, starting with the EBU-leased capacity foreseen in a Eutelsat II satellite, which is due to replace the EBU-leased capacity in a Eutelsat I satellite from 1 January 1993.

For the EVC-G specification, this decision was not so much a case of moving the goal-posts as changing the game from soccer to rugby, necessitating different goal-posts. The new requirement was for serial component-digital signals to be switched and monitored in addition to composite-analogue signals in PAL, SECAM, and NTSC. I opted for a 270 Mbit/s serial component system to meet this new requirement and subsequent developments have confirmed that I backed the right horse.

In fact a mixed network will exist for several years, utilising 34 Mbit/s component-digital transmission via leased satellite circuits and composite-analogue transmission via terrestrial circuits and other satellite circuits. It is obviously unacceptable, in a new installation, to decode the 34 Mbit/s signal to composite-analogue video for switching purposes, because in the long term future, the terrestrial circuits should also utilise 34 Mbit/s signals. Decoding/recoding component-digital/composite-analogue/component-digital for switching purposes would introduce unacceptable degradation.

An alternative approach would be to code all composite-analogue signals to 270 Mbit/s digital-component signals for switching purposes and to decode back to analogue-composite signals where necessary at the output of the switcher. This is a rather expensive solution however. The solution adopted in EVC-G is to utilise a 270 Mbit/s component digital switcher, plus a composite-analogue switcher, to feed component and composite destinations respectively. Corresponding inputs of the two switchers carry the same signal in digital and analogue form respectively, (see *Fig. 2*).

We should note that this solution would not be appropriate for the International Television Centres (ITC) operated by broadcasters connected into

Brian Flowers *studied engineering at the University of Southampton. In 1960 he joined BBC Television News and in 1962 he was detached to the Eurovision Control Centre in Brussels. He has worked at all levels of responsibility at the EVC - technician, supervisor, engineer-in-charge - and is now Head of Service and Project Manager for the new EVC in Geneva.*

the Eurovision network because future international switching of 34 Mbit/s signals should be carried out at 34 Mbit/s. This is because the 270 Mbit/s signal will not carry all the ancillary data contained in the 34 Mbit/s signal. Conditional access information would be lost, for example. Moreover, even though it functions entirely in the digital domain, the 34-270-34 Mbit/s decompression/compression process introduces some degradation. However the EVC-G is not really an international switching centre but rather a monitoring and coordination centre, with only one output to the international network.

This output will be used primarily to inject pre-recorded news items into the daily news exchanges, fed from the EVC-G video-tape recorders.

3. Network and switching aspects

3.1. Network

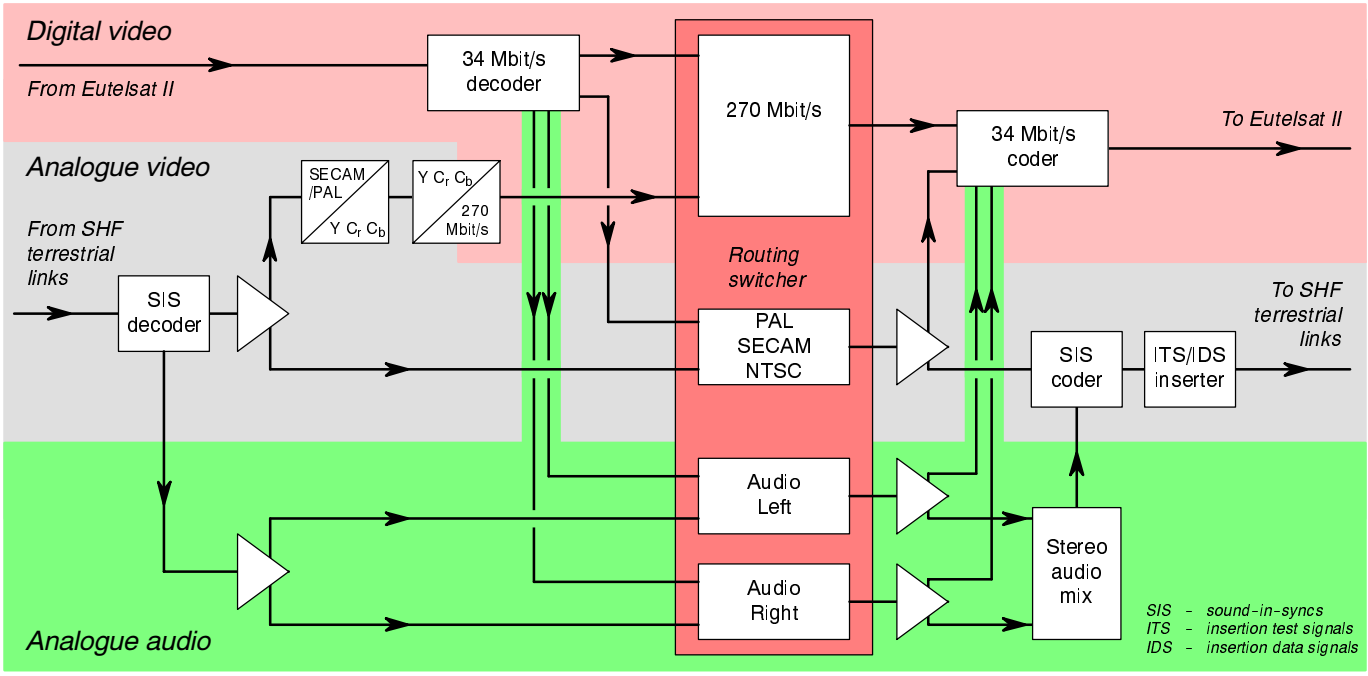
International switching in Switzerland is carried out by the Swiss PTT at its switching centre in Albis near Zurich. From June 1993, the Swiss broadcaster SRG, in Zurich, will take over responsibility for this switching, using a computerised remote-control system.

EVC-G will have three terrestrial microwave circuits from Albis to EBU Geneva to provide monitoring of the Frankfurt-Albis, Vienna-Albis, and Milan-Albis, permanent vision network (PNV) circuits. An EBU Geneva-Albis-Zurich circuit will carry the EVC-G output to the international network. In addition two circuits from the Swiss PTT's network relay station at La Dole to EBU Geneva will provide monitoring of the Lyon-La Dole-Albis and Albis-La Dole-Lyon PNV circuits respectively, (see *Fig. 3*).

All these circuits will utilise a new PTT dish antenna, to be installed on the roof of the existing EBU Geneva building, providing circuits to and from La Dole.

In addition the signals received from the EBU-leased Eutelsat channels via the Swiss PTT's earth-station at Vernier, located a few kilometers from EBU Geneva, will be sent to EVC-G via fibre-optic circuits. Initially there will be six composite analogue signals, (ECSA-F), sent via two OVID-4 fibre-optic units. Each unit can carry four composite analogue signals with two audio channels. In a subsequent development, eight 34 Mbit/s component digital signals will be received from the EBU-leased transponders of Eutelsat II (ECSA-H) via the earth-station at Vernier. These signals will be sent to EBU Geneva using a suitable digital fibre-optic transmission system, this being the responsibility of the Swiss PTT.

Figure 2
Simplified schematic of video and audio configuration

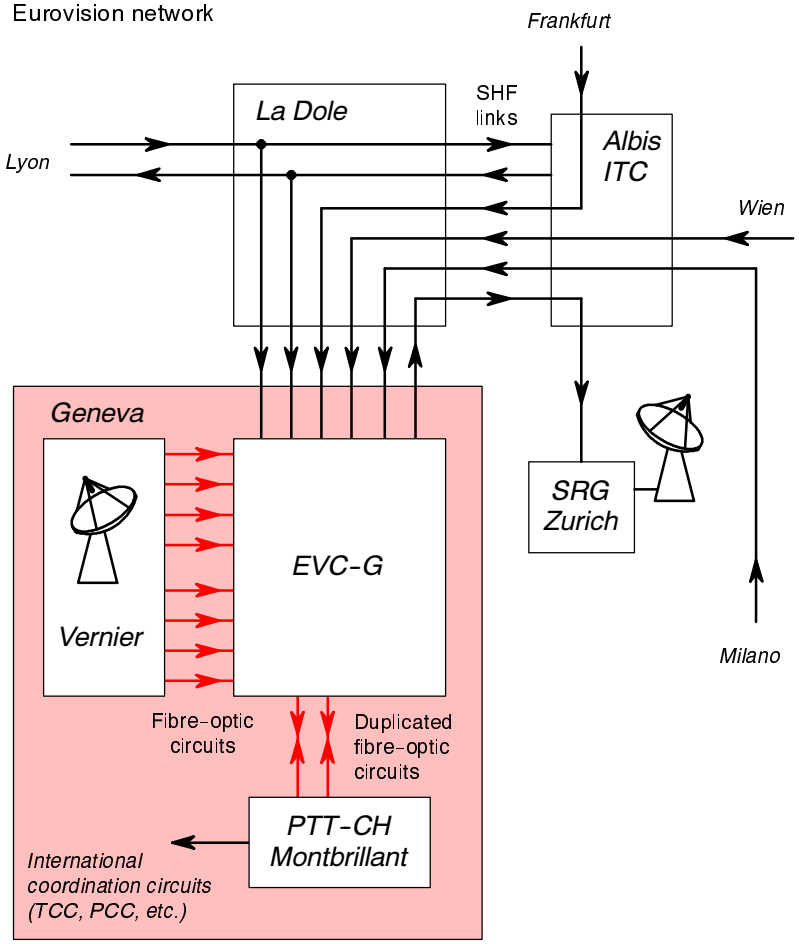


3.2. Switching

To cope with this diversity of standards, the EVC-G switching system must be flexible enough to accept composite analogue video signals from Vernier, initially, and component digital signals at a later date. It will consist of a 48 in/24 out 270-Mbit/s routing switcher manufactured by Alpha Image, a 48 in/24 out analogue video routing switcher from AAVS, and a 48 in/48 out 2-channel analogue audio routing switcher also from AAVS.

I have often been asked why I do not switch the 2-channel audio as an AES/EBU 3 Mbit/s signal. The answer is that since most of the audio sources and destinations are analogue, switching audio as a 3 Mbit/s signal would require a large number of analogue-digital coders and digital-analogue decoders. I calculated that the cost of these units would approximately double the total cost of the switching system.

Figure 3
Incorporation of the EVC-G into the Eurovision network



4. Equipment

To carry out the tasks listed in *Section 1*, the following technical facilities are required:

4.1. Communications

The communications facilities are based on a sophisticated (*n-1*) conference system connected to international 4-wire voice communication circuits.

The (*n-1*) conference system foreseen is a larger and improved version of the existing system in the Brussels EVC. It will be built by the same company, namely SANDAR of Norway, who have considerable experience in this domain. Back-up conference units for the technical coordination conference (TCC) and programme coorrdination conference (PCC) respectively are built into the system, in case the main conference unit should break down (see *Fig. 4*). This "belt-and-braces" approach is adopted for all essential facilities in the EVC-G project.

4.2. Video/audio monitoring and switching

The video and audio monitoring and switching facilities, measurement equipment, intercom equipment, and video recording facilities, form the basis of the main contract.

Several turnkey project companies from the United Kingdom, France, Germany and Switzerland, tendered for the main contract, which was finally awarded to AAVS of Paris. Not only did their proposal contain the most innovative engineering solutions but it was also the cheapest offer. Within this main contract, DRAKE of the United Kingdom will supply a specialised intercom/planning communications system and BARCO of Belgium will supply multi-standard SIS-compatible colour monitors which can be switched between 4:3 and 16:9 aspect ratios. In addition, companies from almost every European country, Japan, and the USA, will supply units of equipment as specified in the main contract.

4.3. Quality control

A wide range of hardware is being installed for automatic video measurement and audio measurement, for quality control purposes.

4.4. Computerised information system

The computerised information system (TPP - Transmission Planning Procedure) is being supplied by British Telecom, this being a separate project managed by my colleague, Bill Lloyd.

4.5. Video recording

The VTR facilities in the Brussels EVC consist of two Ampex VPR-2B 1inch format C machines. They were adapted to be compatible with PAL and SECAM, switching automatically between the two standards.

For EVC-G it was considered more appropriate to utilise Betacam machines for two reasons. Firstly, using a component recording system enables us to record and replay the future 34 Mbit/s component digital video in analogue component form, thereby avoiding the degradation caused by coding into a composite analogue standard. Secondly, if the EBU programme news coordinators are required to take advantage of our future co-location to edit the pre-recorded news material, they would prefer to work with Betacam machines.

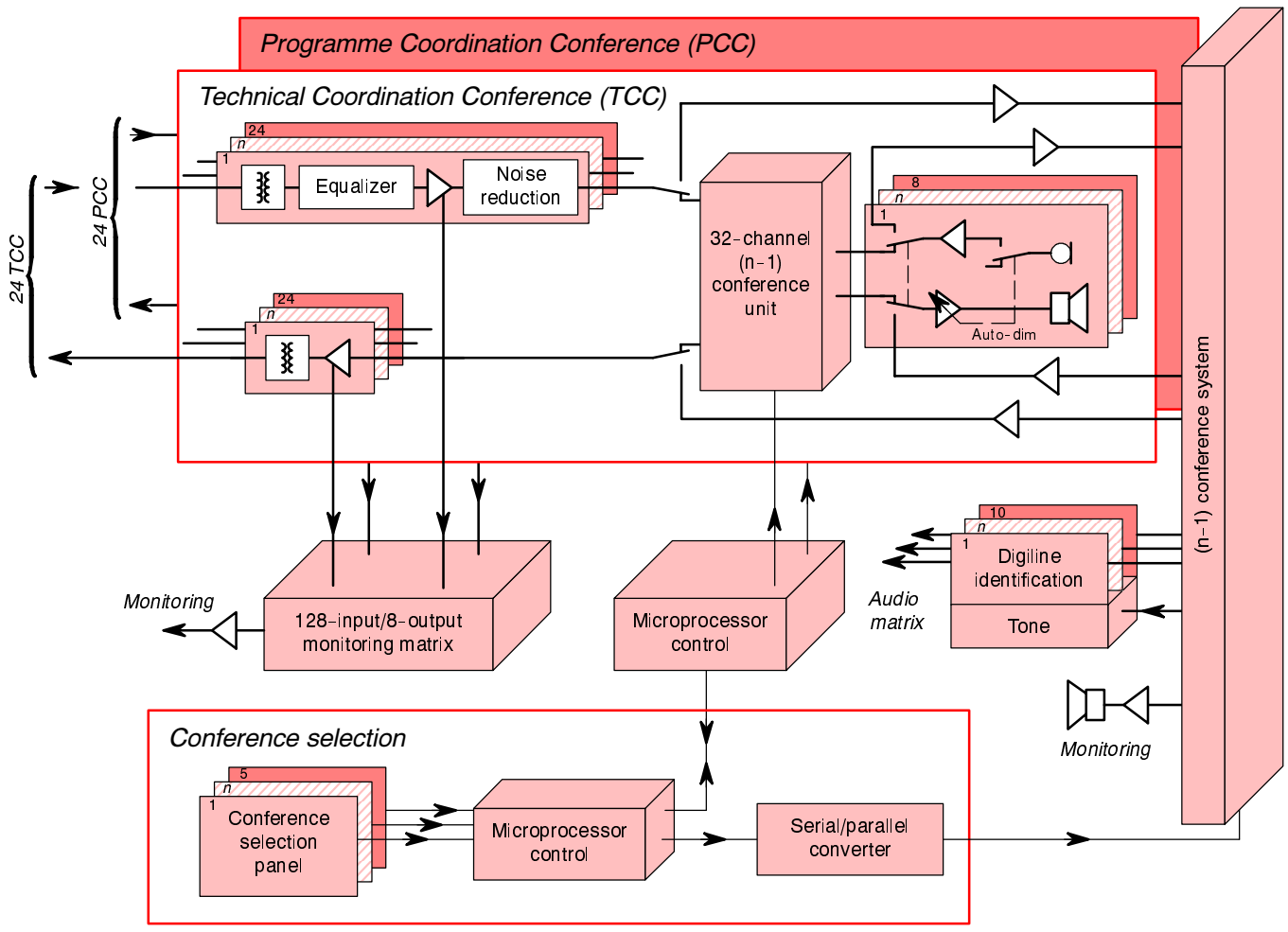
We could ensure even better quality by utilising one of the new component digital machines, such as digital Betacam or the Panasonic D5 machine. Apart from the fact that these machines cost about twice as much as the standard Betacam machines, it was considered too early to go digital in the VTR room. Any editing required is very limited, so we can hardly justify the extra cost of digital immunity to multigeneration degradation.

4.6. Additional facilities

Two additional operational areas are foreseen in EVC-G compared with the Brussels facilities, namely the One Man Coordination desk (OMC) and the HDTV room.

The OMC desk will permit one person to carry out all EVC functions from one position. This will be used during night shifts for example, when the network traffic is relatively light. At very busy times it will provide an additional coordination

Figure 4
(n-1) conference system



facility. (In case anybody accuses us of adopting sexist terminology, I would like to explain that "One Person Coordination" could not be used because "OPC" is already used as the abbreviation for "Occasional Programme Circuit".)

The HDTV room is foreseen for monitoring HDTV test transmissions, which will be organized in the future to evaluate HDTV transmission systems. This room will be equipped in due course, as and when the requirement is confirmed.

5. Creativity

Engineering design work is very enjoyable because it is creative. One unit in the EVC-G project is based on a wider meaning of creativity. A solid-state stereo audio jingle-generator is foreseen to play a 32-second jingle in continuous-loop mode, which will be transmitted in conjunction with the EVC-G video test-pattern between programme transmissions. The chosen music is a flute duet, with which I won the "BBC Children's Hour young composers' competition" in 1952. This choice of music avoids complications with copyright, etc.

Finally I would like to acknowledge the many helpful suggestions received from the various companies who tendered for this project. The staff of the Brussels EVC have also contributed many ideas and suggestions, based on their cumulative experience. Most of my ideas and solutions to problems come to me at 3 o'clock in the morning, after 3 hours' sleep. One's brain apparently continues to analyse problems whilst asleep, which raises the interesting idea of being paid overtime for sleeping!

6. Looking ahead ...

The EVC-G project is now progressing on schedule. The critical factor in the project schedule is the date when the new building will be sufficiently advanced for on-site installation work to commence. This is foreseen from 1st May 1993 and installation work should be completed by the end of June 1993, with acceptance tests and staff training in July and August 1993. On 1st September 1993, EVC-G should become operational.

BBC research on show

Digital Audio Broadcasting and digital HDTV were the star attractions at a series of Open Days at BBC Research Department early in November 1992. The event followed soon after a statement in support of DAB by the UK Ministry responsible for media affairs and there was keen interest from visitors - including many from the domestic electronics and motor-vehicle industries - in demonstrations of a DAB single-frequency network. Highlighting the spectrum efficiency of DAB more than the high-quality of the sound, the government observed that DAB was a means of offering more choice to listeners and that for manufacturers it was a "great opportunity to exploit a new market".

BBC

Just before the Open Days, the BBC and Thomson CSF-LER had successfully transmitted a digital HDTV signal in an 8-MHz terrestrial television channel, and BBC engineers were on hand to explain the principles used in this and related systems currently under study. The demonstration system carried an overall bit-stream of about 60 Mbit/s with a spectral efficiency of the order of 7.5 bit/s/Hz. The techniques involved the separate transmission, on orthogonal linear polarizations, of two 30-Mbit/s bit-streams each comprising an OFDM ensemble of about 500 carriers using digital 64-QAM modulation. The demonstration was intended, originally, to show how such techniques could be used for point-to-point digital HDTV contribution links, although extension of the techniques, and their association with more-powerful digital video compression systems, could permit the broadcast emission of one, or even two, digital HDTV programmes in a single UHF terrestrial channel.

Two of the other research projects on show were concerned with programme routing within production centres. Extended studio PAL is designed to allow digital component video signals to be carried unimpaired though existing PAL equipment. The signal occupies a total bandwidth of 8.8 MHz ($2f_{sc}$) and conveys a total luminance bandwidth of 6.6 MHz and a chrominance bandwidth of 2.2 MHz. Phase segregation is used to allow the luminance and chrominance to overlap without cross-colour or cross-luminance effects, and to ensure compatibility with normal PAL signals and PAL display devices. Other advantages, compared to other enhanced studio systems, are the avoidance of field stores and the accompanying sound/vision synchronization problems.

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